PRICE ONE SHILLING.

PRACTICAL ENLARGING

BY

JOHN A. HODGES,

Vice-president of the West London Photographic Society.

ILLUSTRATED.

LONDON:
ILIFFE & SON, 3, ST. BRIDE STREET, E.C.

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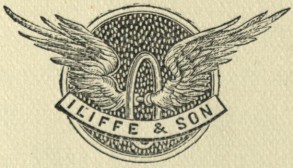

LONDON:
ILIFFE & SON, 3, ST. BRIDE STREET, E.C.
1892.

ILIFFE AND SON,

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PREFACE.

The numerous enquiries upon matters of detail in connection with the practice of enlarging which are continually appearing in the various photographic periodicals, and the absence, in a concise form, of any work upon the subject, lead me to suppose that the publication of a handbook on Practical Enlarging may fill that which has hitherto been to some extent a gap in photographic literature. But in presenting this volume to my fellow-photographers, I wish it to be understood that, although I have endeavoured to treat the subject as comprehensively as possible, yet I do not claim to have done much more than to have collected together, in a handy and concise form for reference, the general information upon the subject.

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PRACTICAL ENLARGING.

SECTION I.

ENLARGING BY ARTIFICIAL LIGHT.

CHAPTER I.

PRELIMINARY CONSIDERATIONS — ADVANTAGE OF ENLARGING—COMPARISON OF METHODS, ETC.

The practice of enlarging amongst amateurs has now become very general, owing in a great measure, no doubt, to the commercial introduction of bromide paper; and the recognition which pictures so produced constantly receive at the various exhibitions and competitions is a sufficient answer to those who seek to challenge the artistic merits of enlarged photographs. A *properly executed enlargement* is, in the opinion of the writer, very often preferable to a direct print, and in many cases is undoubtedly superior. But the great advantage which a knowledge of enlarging confers upon the amateur lies in the fact that he

is thereby enabled to dispense with the discomfort, inconvenience, and expense of working a large-sized plate direct ; for, provided with a small, light, compact camera and half-a-dozen slides, he can walk further and obtain subjects which he could not attempt to grapple with if using large apparatus. There are some who take exception to an enlargement because they assume that it will be less sharp than a direct photograph ; but, putting aside altogether, for the moment, the question of the desirability, from an artistic point of view, of obtaining microscopic definition, the fact remains that a 12 × 10 enlargement from a quarter-plate negative, taken with an aperture of f/8, will possess greater sharpness and definition than will be found in a direct print from a 12 × 10 negative, taken with a lens constructed to cover that size plate and working at the same aperture. The explanation of this apparent paradox is due to the fact that the depth of focus and defining power of lenses is much greater in small short-focus instruments than in large long-focus ones. Thus, a quarter-plate lens of 6in. focus, of the rectilinear type, will give far greater depth of focus, definition, and flatness than will one of twice that focal length ; indeed, in order to obtain approximately the same amount of depth and

definition with the latter, it will probably be necessary to stop down to f/20, or thereabouts. Of course, such a procedure will, in many cases, render the use of an instantaneous shutter an impossibility, and thus it will be seen that working a short-focus lens on a small plate will, at times, enable subjects to be taken that could not be attempted with a long-focus lens and the large camera, and this solely on account of optical difficulties, and not from the mere physical inconveniences of weight and bulk.

Again, on the score of economy, the practice of making small negatives with a view to their subsequent enlargement has much to recommend it. There are some to whom expense is a matter of secondary importance; but they are, unfortunately, in the minority, and to the great majority of those who practice photography as a hobby, economical methods of working will have strong claims. To such, therefore, I would say emphatically, "buy a small camera and enlarge your small negatives." What its exact dimensions shall be, will, to some extent, depend upon circumstances, but it certainly should not exceed the popular half-plate. Personally, I have a strong predilection in favour of the 5 × 4, a size not very popular in this country, though very generally used

in America, where it has, to a great extent, superseded the quarter-plate. Its chief advantages are that it is sufficiently large to make a very presentable direct print, and that it conveniently enlarges to two diameters on a 10 × 8 plate without sacrificing its proportions. Enough has probably been said on behalf of enlarging to make out a strong case in favour of its right to exist as one of the most valuable methods of picture making open to photographers. The various modes of working, and the different processes in vogue I shall endeavour to describe in their proper places in succeeding chapters, and after perusing them it will be for the reader to decide what particular process and mode of working best suits his own requirements. For my own part, I much prefer to make an enlarged negative, and from that print by the process most suitable to the subject, but generally on home-sensitised rough Whatman paper, toned with either platinum or gold. I unhesitatingly give utterance to the opinion that prints so produced are incapable of being discriminated from those obtained on similar rough surfaces from direct negatives.

The first point the reader will have to decide before taking up the practice of enlarging will

naturally be, whether he shall employ daylight for the purpose, or whether he shall resort to the employment of artificial light. Each method will be fully treated in succeeding chapters, and it may be fairly said that each has its advantages and its disadvantages. By adopting artificial light one is at once independent of daylight, and work can be carried on in the evening. On the other hand, there is a decided advantage when using daylight in the sharpness of the results, and it is a significant fact that, notwithstanding its variable quantity, most professional enlargers employ it in preference to artificial light.

CHAPTER II.

General Principles of the Artificial Light Method—Mechanical and Optical Construction of Apparatus, Optics, Lenses, Illuminants, &c.

The general principle involved in the construction and use of an apparatus for enlarging by artificial light is to be found in the ordinary optical lantern, and, indeed, under certain conditions, hereafter to be noted, the optical lantern itself will serve to produce enlargements. Briefly, an enlarging apparatus consists of (1) the body or containing chamber, (2) the source of light, (3) the condenser, (4) the objective, or projecting lens.

(1) *The Body.* The purpose of the body is to contain the source of light, and to form a support for the optical system. Its size will, of course, be determined by the diameter of the condenser which is to be employed. It should be constructed of metal, preferably, and on account of its great durability, of the material known as Russian iron, or of stout sheet tin; it may be provided with an outer covering of wood, but such an addition would be a refinement rather than a matter of

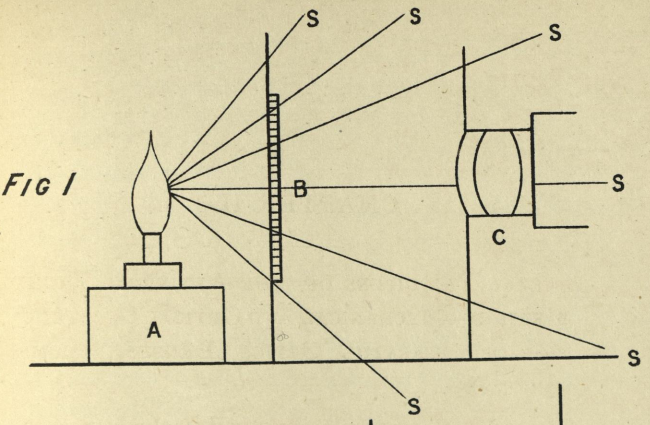


FIG 1

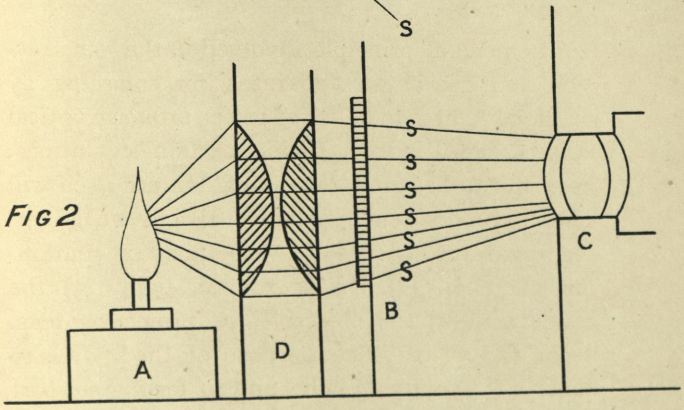


FIG 2

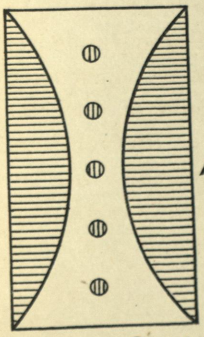


FIG 3

Ordinary Condenser.

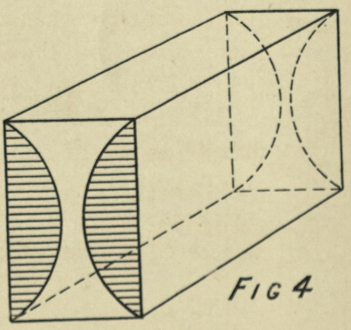


FIG 4

Rectangular Condenser.

practical utility. Its shape is immaterial, so long as proper provision for efficient ventilation is provided, but at the same time care must be taken to so trap all air inlets as to prevent the leakage of white light.

(2) *The Source of Light.* The selection of a suitable illuminant is a matter which will probably perplex the reader more than anything else connected with the setting up of an enlarging apparatus. There are many systems from which to choose, the chief of which, for the guidance of those not familiar with the subject, I propose briefly to describe.

I mention first of all the electric light, but only to dismiss it as being beyond the reach of the majority. Where it can be obtained, however, it will be found to be the best of all methods of artificial illumination. The most suitable form in which to employ it is the arc light; and there are now several forms of lamps to be obtained which will be found to give a fairly steady light. Good results are also to be obtained with the incandescent light, and although the photometric value of the latter is far less than the arc light, yet it is infinitely more manageable and steady.

After the electric light, for general efficiency come the various forms of limelight, and those

who are acquainted with its use should, without hesitation, adopt it for enlarging purposes. Preference should be given to the employment of the mixed jet, which gives a small and intense light, those being the conditions to be aimed at. The blow-through or safety jet will also answer well, as will the older form of burner known as the oxy-calcium or spirit jet, in which the flame of a spirit lamp takes the place of the house gas or hydrogen.

Next, in point of utility, come the various kinds of lamps, in which petroleum or other mineral oil is burnt. The lamps generally supplied with commercial enlarging lanterns are of the parallel wick type, commonly met with in the ordinary optical lantern used for projection purposes. These are furnished with from two to five wicks, and, if properly constructed, give a light of great intensity, but though admirable for ordinary projection work they are not so suitable for enlarging as they would at first sight seem to be. This form of lamp appears to be at its best when provided with but three wicks, the addition of a greater number not seeming to materially increase the brilliancy of the light or its intensity, and certainly greatly increasing the tendency to smoke, besides introducing other disturbing in-

fluences which are better eliminated, for equality of illumination and sharpness of image can only be secured when the source of light itself is both small and intense. If oil is to be employed, I believe the best results will be obtained when using an ordinary burner of the Argand type about one inch in diameter. This will be found to give better definition and greater sharpness than the ordinary parallel wick lamp of the shops, although the light itself will not be quite so powerful. If a more powerful light of this class is desired, then will that form of burner known as the Mitrailleuse fulfil all requirements if the size of the flame be reduced by putting an opaque screen with a hole $\frac{3}{4}$in. in diameter in front of it. While upon this subject a word or two upon the proper use of an oil light may not be out of place. The amount of light to be obtained from any oil lamp will depend to a great extent upon the care and skill of the operator in using it. There are some people who will obtain twice as much light from an ordinary 3-wick lamp than others, but attention to the following points should ensure good results. In the first place it is most essential that good oil only be used, the best kerosene, costing about 1s. per gallon, will be found most suitable. If pure it should be free from odour and without

colour. The wicks must also be of good quality and clean, a dirty or soiled wick will prevent the free flow of the oil through it, and the flame will consequently be badly supplied with fuel. The performance of the lamp will depend also in a great measure on the proper trimming of the wicks. I find for this purpose that a razor answers better than scissors. The wick should be clean cut, and perfectly parallel with the top of the wick chamber; if the corners are cut, as shown in the diagram, the tendency of the flame to fork at its extremities will be greatly reduced. After lighting the lamp should be turned down low, and the wicks gradually raised at intervals of a few minutes, until the maximum of light, short of smoking, is obtained. The careful worker will probably deem these hints superfluous, but I have, in many instances, traced failures to their neglect. Some operators advise the addition of camphor to the oil, but my own experience shows me that, although the luminosity of the flame may be somewhat increased, any slight advantage in this respect is more than counterbalanced by the increased tendency to smoke, and moreover, the dissolved camphor is quickly absorbed in the loose fibres of the wicks, which consequently quickly become clogged. The

apartment in which the lantern is in use should be efficiently ventilated. It is astonishing what an effect this has upon the performance of an oil lamp. I once had occasion to give a demonstration illustrated by a few diagrams, and I took my "Pamphengos" lantern down to the hall for the purpose. I found to my surprise that the lamp, which had burnt splendidly the night before at home, would not give sufficient light to project an ordinary slide, and no amount of coaxing improved its burning, but upon taking the lamp to an adjoining apartment the lamp at once burnt with its usual brilliancy, proving that its defective performance was due to an insufficient supply of oxygen in the atmosphere, a condition of things brought about by the crowded state of the room and insufficient provision for the admission of fresh air.

At first sight it would seem that gas would provide us with a ready and convenient means of illumination, but a perfect gas lamp suitable for enlarging or projection purposes yet remains to be invented. At the time of writing, however, I have just had the opportunity of witnessing some experiments with what promises to be the most efficient light of this class, at the premises of the Incandescent Gaslight Co., who, by an adaptation of their well-known Welsbach burner, have suc-

ceeded in producing a brilliant, white, and extremely steady light of about 150 candle power. The light is produced by supplying a modification of the Welsbach burner with highly carburreted air, the result being an intense and white light highly suitable for either enlarging or projecting purposes. Although the initial cost of the apparatus is rather high, the actual cost of working is extremely small, the carburetting of 1,000 feet of air by impregnation with the vapour of benzoline being effected at a cost of about 6d. The ordinary form of Welsbach burner supplied with gas from the main may also be used; it gives a steady and fairly intense light of about 25 candle power. The luminosity of ordinary gas is greatly increased by causing it to be impregnated with carbon on the principle introduced by the Albo-carbon Light Co. The albo-carbon light itself may be used, or the modification of it suggested by Mr. Traill Taylor, which consists of two fish-tail burners mounted with their flat surfaces facing the condenser, and with a diaphragm in front to cut off the margin of the flame and so curtail its dimensions. I have not tried this burner myself, but the fact of its having been introduced by Mr. Taylor is sufficient warranty for its suitability for the purpose. I have, how-

ever, used Argand burners of several types, which, when supplied with a gas enriched with hydro-carbon, have given good results.

Having now, I believe, described almost every method of illumination which could be applied to the purpose in view, and pointed out the merits and demerits of each, it will be for the reader to determine which system best meets his own requirements, and in making the selection he will, of course, to a great extent, be governed by circumstances. The limelight will strongly commend itself to those who are accustomed to use it in connection with the optical lantern, and if compressed gas in bottles be employed, the materials for its production are ready at hand at a moment's notice. After this, in point of utility, I should be inclined to put the Areo-carbon light, previously described, then an efficient oil lamp, and, lastly, gas.

(3) *The Condenser.* It now becomes necessary to consider that portion of the optical system of an enlarging apparatus commonly called "the condenser," and it will perhaps be useful to briefly consider the object which it is intended to serve. Its function is to collect the rays of light which emanate from the lamp or other source of light, and project them through the negative which is to

be enlarged. In fig. 1 we have a representation of what occurs when we seek to dispense with the use of a condenser, A being the lamp, B the negative, and C the enlarging lens, the lines SSS representing the rays of light proceeding from the lamp. It will be seen not only that a large number of rays do not pass through the negative at all, but of those which do only a small proportion reach the enlarging lens itself. When, however, a condenser D is interposed we have the result shown in fig. 2, the hitherto scattered rays are refracted, that is to say, caught up and bent and caused to pass through the condenser and in the direction of the objective, thus causing the negative to be brilliantly and evenly illuminated.

The form of condenser now almost universally adopted by opticians consists of two plano-convex lenses mounted in a cell, with their convex surfaces nearly touching, as shown in fig. 3. The glass of which they are constructed should be as nearly colourless as possible, and free from striæ or air bubbles, as such defects would probably cause distortion of the image. Various complex systems of condensing lenses have been from time to time devised, but such systems are costly, and the slight advantage to be gained from their adoption would not warrant the amateur in adopting them.

The latest modification in the form of the condenser is that brought out by Hughes, in which the lenses, instead of being circular, as usually constructed, are rectangular in form. The advantages claimed for this system are the reduced size of the apparatus, coupled with the better definition and greater evenness of illumination (fig. 4). In selecting a condenser, see that the lenses are quite loosely mounted in the cell, otherwise they will probably fracture when they become heated. The cell itself should have holes drilled in it, in order to allow of the rapid condensation and dispersion of any moisture which may condense on the inner surfaces of the lenses.

(4) *The Objective or Enlarging Lens.* Speaking generally it may be said that any lens that will take a photograph will also serve to enlarge it, but, at the same time, the selection of a suitable lens is a very important matter, inasmuch as it will, to a great extent, influence the quality of the enlargement itself. A good lens is absolutely essential to successful working, and the greatest care should be exercised in choosing it ; therefore, unless the reader is fully competent to discriminate between good and bad, he should seek the assistance of someone possessing the necessary knowledge. Whatever be the form of lens employed,

if the best results obtainable are desired, its focus should be long in comparison with the plate to be enlarged. Attention to this rule will ensure flatness of field in the enlarged image, and, consequently, good marginal definition. As an example, if quarter-plate negatives are to be enlarged a half-plate lens should be used for the purpose.

A portrait lens is usually recommended for enlarging, and most commercial enlarging lanterns are provided with lenses of that type, probably on account of its rapidity. Although it may be used with its full aperture when enlarging from a portrait, or single figure, yet when it is required to enlarge a group or landscape where good marginal definition is essential, it becomes necessary to stop down considerably before the desired result is obtained, but it will be apparent that in so doing the chief advantage of the lens, namely, its rapidity, is sacrificed. For all-round work, therefore, a lens of the so-called "rapid" type will be found most suitable. When a rapid exposure is imperative it may be used with its full aperture, and is then not much behind the portrait lens in point of rapidity, while its flatness of field and defining power is far greater. To obtain the finest results the lens used should be capable of covering a plate larger than that from which the enlarge-

ment is to be made. For instance, if the original negatives are quarter-plates, the lens used to enlarge them should be a half-plate. The reason for this rule is not far to seek. The field of all lenses when working with large apertures (which is a condition which usually obtains when enlarging) is only flat in the centre, and therefore it will be apparent that in using a long-focus lens to enlarge a small plate we shall be utilising only the best and flattest portion of its field, and shall thereby secure greater sharpness and better marginal definition in our enlargements. After making a great many comparative tests, I am quite convinced that, where great rapidity is not sought for, the triplet, a form of lens most unfortunately now nearly obsolete, is the best lens that can be used for enlarging purposes, and its superiority in regard to the particular quality which we have just been considering, namely, flatness of field, over the rapid rectilinear is most surprising. For making enlarged negatives, or for work requiring great sharpness and fine definition, it cannot be surpassed. Therefore, should an opportunity of purchasing one occur to the reader, he should by no means let it pass. The portable symmetricals of Ross make capital lenses for enlarging, although their

slowness precludes their use for anything but daylight work. A single lens will also answer, although for working by artificial light it is, on account of its slowness, open to the same objection as the last-named lens. I may here state that the foregoing observations on lenses apply equally whether daylight or artificial illumination is employed.

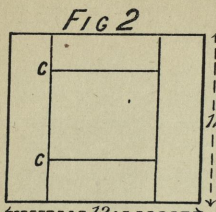


FIG 2
C
C
Side
12"
12

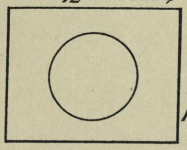


FIG 3

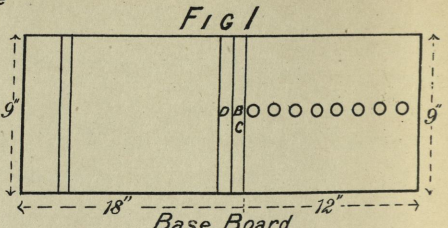


FIG 1
9"
C
9"
18"
12"
Base Board

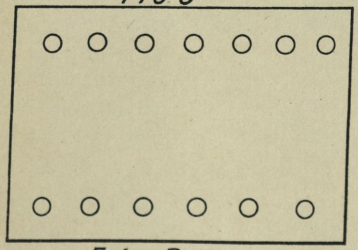
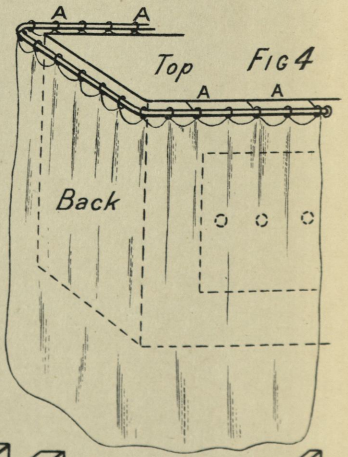


FIG 5
False Bottom


A
A
Top
FIG 4
A
A
Back

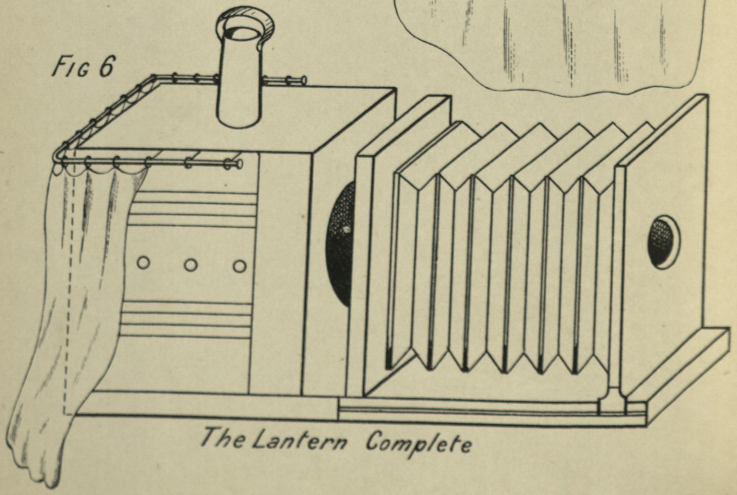


FIG 6
The Lantern Complete

CHAPTER III.

How to Make an Enlarging Lantern.

The enlarging lantern of the shops is, necessarily, rather an expensive piece of apparatus, and probably the economically-minded photographer, who possesses the necessary mechanical ability, and who understands the use of tools, may, not unnaturally, prefer to construct one for himself. I therefore propose to devote the present chapter to the description of the construction of a simple but efficient form of enlarging lantern which I once constructed for my own use. The dimensions which I shall give are suitable for a condenser 6in. in diameter, and, of course, if a larger or smaller condenser is employed, they must be modified accordingly, although the general lines of the construction will be the same. The diameter of the condenser will be determined by the size of the negatives which are to be enlarged, and may easily be ascertained by sketching on a piece of paper the exact size of the plate to be enlarged, and then describing round it a circle sufficiently large to include the diagonals of the plate within its

circumference. If this experiment be performed with a ¼-plate it will be found that a condenser of 5½ inches will just do this—but experience shows that much better results are gained by allowing a little margin, and therefore it is that I recommend the adoption of the 6-inch lens. A large condenser is a costly article, but one suitable for the purpose should be obtainable for about 25s., or, if second-hand, probably for less. Now before actually getting to work I must preface these instructions with a word of caution. It matters not how rough the general construction of the apparatus may be provided one point be attended to, namely, the absolute parallelism of all the parts, for if any part be in the slightest degree "out," good results can never be obtained. By this I mean that the light must be properly centred, and the condenser, the stage carrying the negative, and the wood-work carrying the objective, must all be absolutely parallel with each other.

A piece of well-seasoned pine or mahogany, 1in. thick, 9in. broad, and 2ft. 6in. long, must be obtained to form the base. On its under side, at each end, fillets of wood 1in. square are to be screwed, a row of holes ¾in. in diameter being bored out at the letters AAA, etc., in fig. 1. These are to afford ventilation. Mark off a line

at B with a T-square, 12in. from the end at which the holes are bored. Now select a sound piece of mahogany, about 1½in. thick, 9in. broad, and 12in. long; upon this lay the condenser, mounted in its cell, quite centrally, and with a pencil carefully trace its position. The marked portion is then to be carefully cut out with a key-hole saw. Into the hole so made, the condenser should just fit firmly. This will form the front of the lantern proper, and may now be carefully screwed down to the base-board at the line already marked at B. The sides are to be constructed by mortising together four pieces of pine or mahogany, about 1in. thick, an opening 6in. square being left in the centres for the doors; the outside dimension of these sides will be 12in. by 12in. When finished they are to be glued and screwed to the baseboard and front. The doors should be made of three pieces of wood clamped to prevent warping, and should be hinged at CC, and open outwards. Before making the top, the reader must decide upon his illuminant. If he elect to employ the limelight, then the roof may consist simply of a stout piece of tin, in the centre of which a hole has been bored, and over which a piece of stovepipe, provided with a cap to prevent the escape of

light, has been fitted. If, however, he employ a lamp of the usual three-wick type, he may dispense with the chimney, as the lamp itself is provided with one, but a slit, wide enough to allow the lamp chimney to move freely backwards and forwards, must be cut in the roof to allow of the necessary adjustment and centring of the lamp. When the lantern is in use, and the light has been centred, the portion of the slit in the roof, not occupied by the chimney, may be covered with a strip of tin to exclude stray light.

At present we have left the back of the lantern quite open so that we may have free access to the interior of the lantern to manipulate and attend to the light, but provision must also be made for preventing the escape of white light into the room while the enlargement is being made. To effect this a curtain will be found far more convenient than a door. We therefore screw on the top of each of the sides three screw-eyes, as shown at AAAAAA in fig. 4. A piece of stout brass wire is then taken and bent round to the form of the top of the lantern. A double thickness of black twill suspended by small rings from this rod will, when the rod is pushed up close to the lantern, effectually prevent white light from escaping. When it becomes necessary to manipulate the

lamp, the rod with the curtain may be completely removed by simply pulling it out of the eyelets.

We have now to turn our attention to the front portion of the enlarging lantern. Mark off at C on the baseboard (fig. 1), three-quarters of an inch in front of the upright carrying condenser, another parallel line, and screw down a second piece of 1in. wood, 9in. broad and 12in. high, which has had an opening cut out of its centre corresponding to the previous one, but 7in. in diameter instead of 6in. (D fig. 1). A third piece of wood of the same dimensions, but without the hole, will form the front. This last, however, must not be screwed down, but two brass runners, to be procured from any camera maker, should be attached to the bottom, the bent edges of which can work in narrow grooves, which should have been previously made in the sides of the baseboard with a "plough" plane. When fitted together the front should move rather stiffly so as to allow of a rough adjustment of the enlargement, the final focussing being effected by means to be described later. A bellows capable of expanding to about 18 inches must now be procured and glued to D and E. A frame on the principle of an ordinary carrier must now be made to hold the negative in position for enlarging at C (fig. 1). Narrow fillets

of wood will have to be glued inside bottom portion of the lantern body to support a false bottom made of stout tin in which two rows of holes as shown at fig. 5 have been punched. The height of this false bottom from the floor can only be ascertained by experiment, as it will depend upon the shape and construction of the lamp employed. When the apparatus is finished up to this stage (the objective, of course, having been screwed on to the front) the lamp may be lighted; but in all probability the illumination of the disc will be very unsatisfactory, the lamp must therefore be raised or lowered until an evenly lighted disc results; the position of the false bottom can then be marked, and the fillets glued and screwed in, when the lantern will be ready for use. I should have said that before gluing the bellows to the front carrying the objective, a hole should have been cut exactly in the optical centre, and the flange of the objective screwed on. As photographic lenses are now very seldom fitted with racks and pinions, some provision for focussing must be devised. The cheapest plan is to take the lens to a working optician and ask him to fit to it a "jacket flange." This is a flange with a cloth-lined jacket, into which the lens slides easily, thus permitting the focussing of the image to be

accurately performed. An alternative but more expensive method of attaining the same result would be by fitting the sliding front of the enlarging lantern with a rack and pinion. The whole apparatus should now receive two coats of Tyler's Black, when, if the instructions have been properly carried out, the reader will be in possession of a thoroughly efficient enlarging lantern, capable of doing all that can be done with an apparatus costing pounds instead of shillings.

CHAPTER IV.

Enlarging by Artificial Light without the Employment of a Condenser—the Apparatus Described.

There is another method of enlarging by artificial light, to which I have not yet adverted, which dispenses with the costly condenser, and gives excellent results—the only disadvantage being that the exposure is necessarily very considerably longer than when a condenser is employed. The idea is to strongly and evenly illuminate a translucent substance, such as a piece of opal glass, in front of and nearly in contact with which the negative to be enlarged is placed, the projecting portion of the apparatus being similar to that found in enlarging lanterns in which a condenser is employed. The original suggestion was, I believe, due to M. Hutenet, who exhibited a lantern constructed upon similar lines before the Photographic Society of France. If the reader prefer to employ this method, he may follow the general lines of construction described in the last

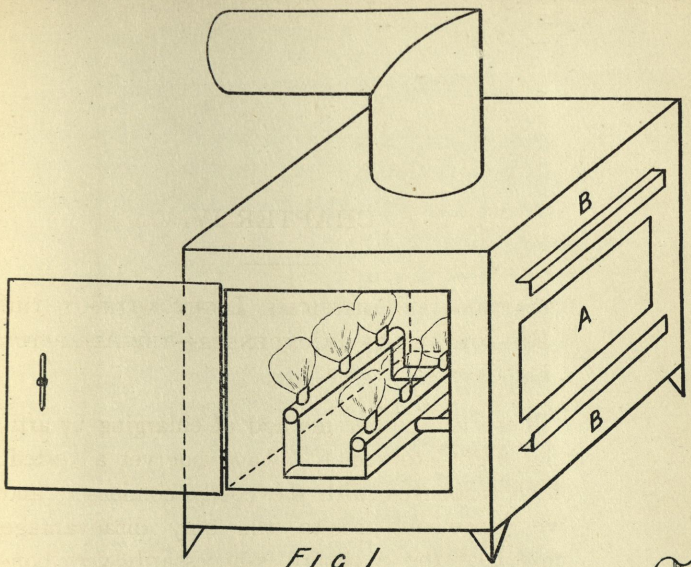


FIG 1

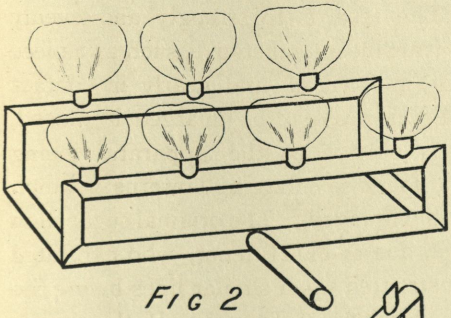


FIG 2

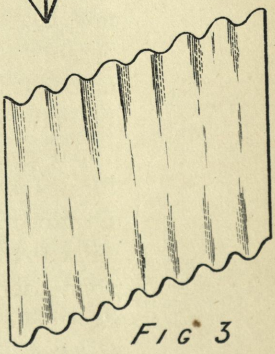


FIG 3

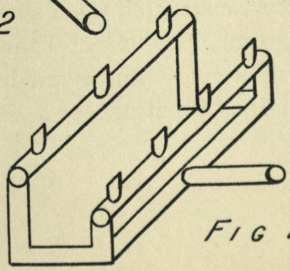


FIG 2

chapter, and it will not be necessary to go over the same ground again. The baseboard and the front portion of the lantern, therefore, can be constructed according to the direction there given, but the lantern body proper will have to be made somewhat differently. In this case on account of the great heat necessarily evolved by the illuminating system, the body must be constructed of metal — either Russian iron or stout sheet tin. The economically minded may procure from the grocer or oilman one of the tins in which glycerine is stored. These are about twice the size of an ordinary biscuit box, but much more strongly constructed, and will admirably answer the purpose to which we intend to apply them. An opening A must be cut out on one side, a little larger in dimensions than the negatives to be enlarged, and on the outside two strips of tin (B B) bent to form a groove must be soldered; these will form the supports for the opal glass. Holes must be punched in the bottom for the purposes of ventilation, which must be trapped in the manner already described, and a portion of the back or side cut out to form a door to allow of the proper manipulation of the light. Now comes the question of illumination, and after making several experiments, I have come to the

conclusion that, where it can be obtained, gas forms the best illuminant. As I have before said, the object is to illuminate the negative as evenly and brightly as possible, and the best means of doing so is to have made at a gas fitter's a fitting constructed on the lines indicated in the diagram at fig. 2. It consists of seven small burners arranged in two tiers, one slightly above the other, forming practically when lighted a thin wall of flame. As the heat given out by such a system is very considerable, ample provision must be made for ventilation by providing a sufficient number of holes at the bottom of the lantern to freely admit cool air, and making the chimney at the top sufficiently large to rapidly carry off the products of combustion. Where gas cannot be procured, paraffin may be used as a substitute by arranging a series of flat flame burners in a row, but the result so obtained is not so perfect as when gas is employed, the difficulty of obtaining even illumination being much greater. Extreme care also must be taken to prevent heating of the reservoir containing the oil, or an explosion might ensue. The back of the lantern should be provided with a reflector, larger in dimensions than the negatives to be enlarged from, so that as much light as possible may be utilised. A piece of the

silvered corrugated glass, similiar to that used in Chappuis' celebrated reflectors, will answer admirably. (Fig. 3.)

A further modification of this system was described in a recent almanac, in which, instead of the rows of oil or gas jets, the writer recommended the employment of a Belge lamp, screened with an ordinary opal globe, as the illuminant. I have not tried this method, but should suppose that it would give good results. The whole of the plate, however, would probably not be so evenly illuminated as it would be by the method I have just described.

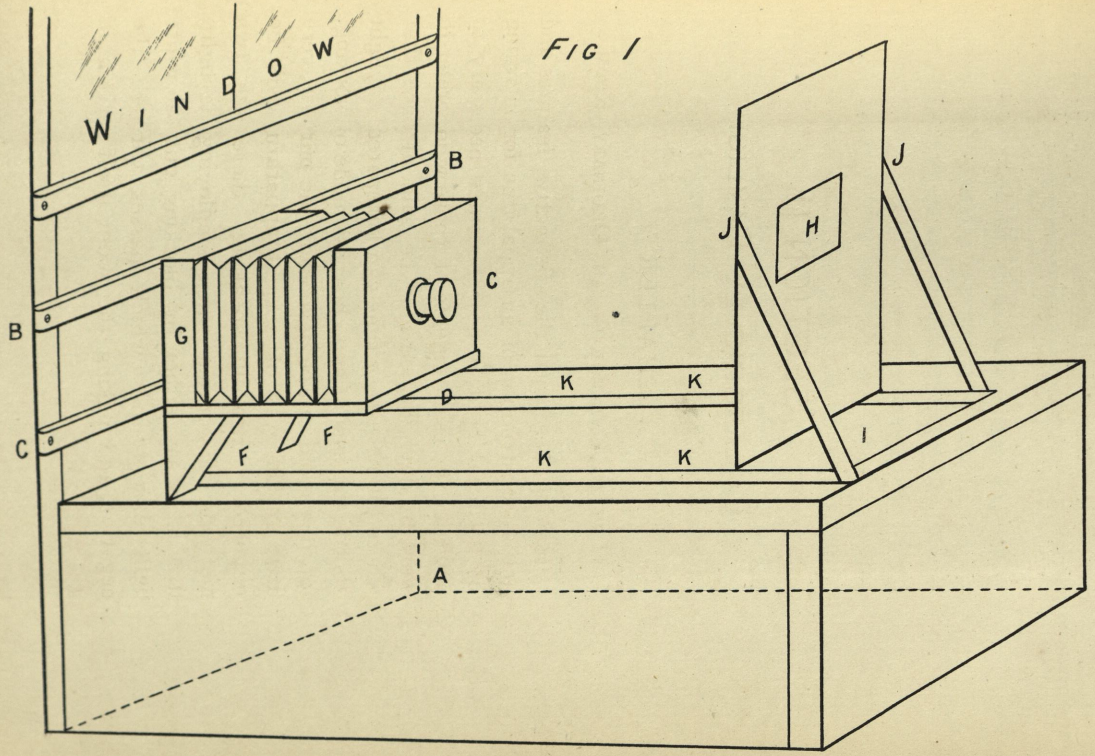
SECTION II.

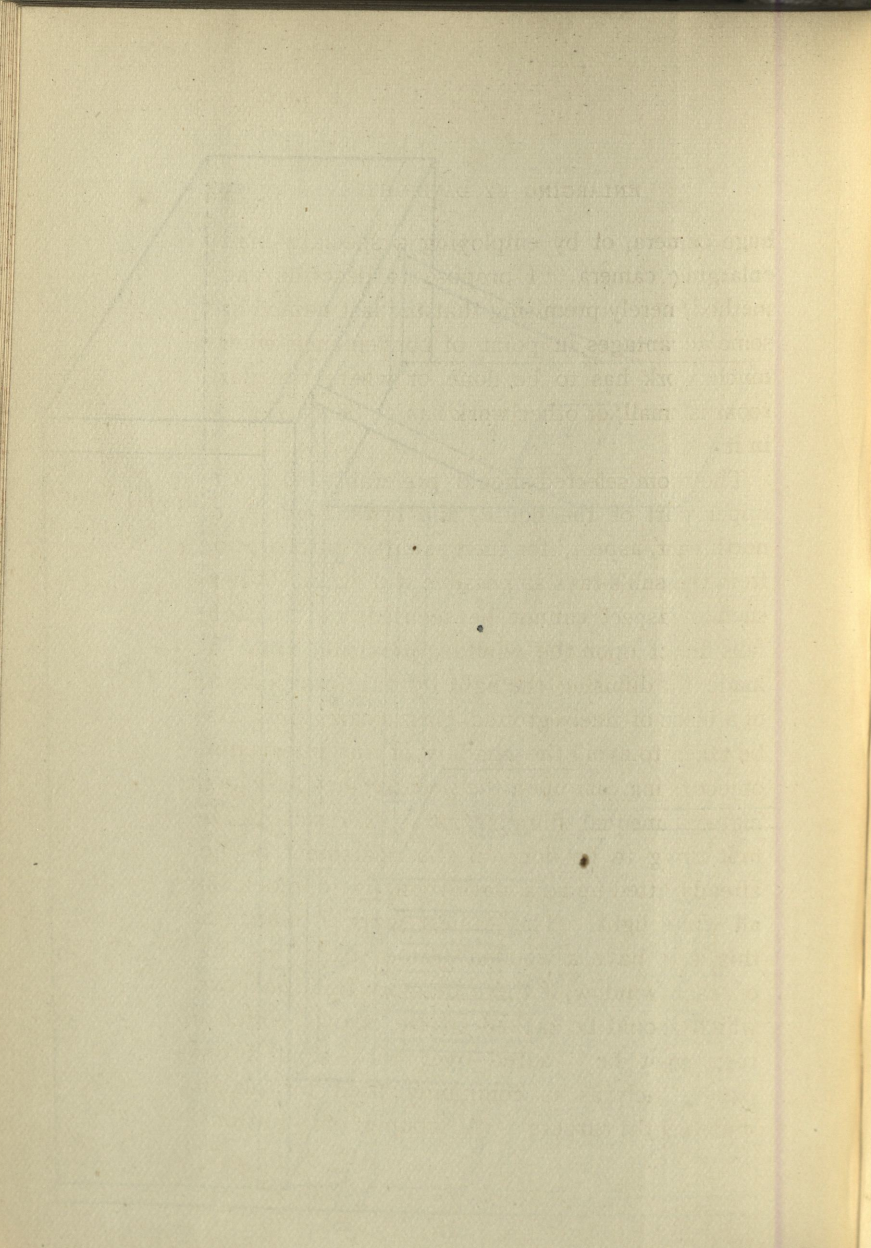
ENLARGING BY DAYLIGHT.

CHAPTER V.

HOW TO ENLARGE IN AN ORDINARY ROOM.

Having described the distinctive features and actual construction of an apparatus for enlarging by artificial light, it now becomes necessary to consider the requirements of those who prefer to work by daylight. It may be said at once that where the necessary time can be spared daylight affords the easiest and cheapest mode of working, for, if a room can be devoted to the purpose, very little in the way of special apparatus will be required. Broadly speaking, there are two methods of working when employing daylight, that is to say, either by blocking out all white light except that which passes through the negative, and making the room itself serve as a


WINDOW
FIG 1
B
B
C
C
G
D
K
K
K
K
F
F
J
J
H
I
A



huge camera, or by employing a specially-made enlarging camera. I propose to describe each method, merely premising that the last named has some advantages in point of convenience where much work has to be done, or where the dark room is small, or other work has to be carried on in it.

The room selected should preferably be in the upper part of the house, and have a north, or north-east, aspect, for then as little interruption from the sun's rays as possible will occur. Where such an aspect cannot be secured, and sunlight falls direct upon the window, provision must be made for diffusing the light by the interposition of a piece of finely-ground glass; care must also be taken to avoid the shadow of any intervening object being cast upon the negative while enlarging, or unequal illumination will result. The first thing to be done, if the apartment be not already fitted up as a dark-room, is to block out all white light. The easiest way of managing this is to have a wooden frame made the size of each window, if there be more than one, over which should be tacked coarse canvas, which in turn must be asted over with stout brown paper, such as is commonly used for placing underneath carpets. A couple of "buttons"

screwed into the sash frame will keep these frames firmly in position, and will enable them to be quickly removed when not in use. An ordinary deal table about 5ft. long should be procured and placed directly underneath the window at which the enlargements are to be made, A fig. 1, or, instead of the table, a bench made of two or three boards secured together with cross pieces, and supported on trestles may be used, or if a special enlarging easel, such as will hereafter be described, running on rails be preferred, both table and bench may be dispensed with. In describing this mode of working it will be useless to specify exact dimensions, as they will necessarily vary in every case. About a foot above the table or bench a strip of wood three inches wide must be screwed to the frame, and also a similar one about 12 inches above the first as shown at BB and CC in the diagram. These will serve as supports to which the enlarging camera is to be affixed. The portion of the canvas and brown paper backing marked D, fig. 2, can now be cut out, and a piece of ½ inch board, 11 inches wide, and 18 inches long, screwed to the centre of the lower cross piece at E, this shelf being strengthened by struts FF underneath. A frame of ½ inch wood, 12 inches square, and two

inches deep, is to be screwed to the window end of the shelf, as shown at G, four strips of wood having been glued inside to form a support for the negative carriers which are to fit inside. Two other frames, of exactly similar dimensions to the one just described, namely, 12 × 12 × 2, must also be made, one of which is to be covered on one side with thin wood, preferably mahogany, so as to form a kind of tray. These will form respectively the back and front of the enlarging camera, and they may now be connected by glueing in a cloth bellows, the method of making which is described in Chap. 6. A hole is cut out exactly in the centre of the front tray-shaped piece, and the flange of the lens which is to be used attached. To make the easel a common deal drawing board, 36 × 20, is obtained (H), a piece of the floor boarding, 20in. long, being screwed to one end, as shown in fig. at I, to form a support, it being further strengthened by struts J J behind. As I have previously mentioned, it is very essential that the easel be kept parallel with the lens and the negative, and, to ensure this, two fillets of wood KK, one inch square, should be screwed down to the bench or table, 20 inches apart, so that the easel may travel on its support rather stiffly between them.

To use the apparatus the negative to be enlarged is placed in its carrier *in situ*, the lens being screwed on at B; the enlarged image will then fall upon the easel, which should have had pasted over it a sheet of pure white paper in order to facilitate the operation of focussing. The degree of amplification of the enlarged image will depend upon the distance between the lens and the negative. The nearer the lens is approached to the negative the greater will be the magnitude of the enlarged image, and the further will the easel have to be removed from the lens. At the end of this chapter a table will be found showing the relative distances of the lens from the easel, and the negative for use with lenses of different focal lengths. The operation of focussing will be rendered easier if a square hole is cut out of the centre of the drawing board, and a piece of finely ground glass let in, flush with the front surface as shown in the figure.

TABLE OF ENLARGEMENT AND REDUCTION.

Focus of Lens in Inches.	Times of Enlargement and Reduction.										Focus of Lens in Inches.
	1	2	3	4	5	6	7	8	9	10	
4½	9 9	13½ 6¾	18 6	22½ 5⅝	27 5⅖	31½ 5¼	36 5⅐	40½ 5 1/16	45 5	49½ 4 19/20	4½
5	10 10	15 7½	20 6⅔	25 6¼	30 6	35 5⅚	40 5⅞	45 5⅝	50 5⅝	55 5½	5
6	12 12	18 9	24 8	30 7½	36 7⅕	42 7	48 6⅞	54 6¾	60 6⅔	66 6⅜	6
7	14 14	21 10½	28 9⅓	35 8¾	42 8⅖	49 8⅙	56 8	63 7⅞	70 7⅞	77 7 7/10	7
7½	15 15	22½ 11¼	30 10	37½ 9⅜	45 9	52½ 8½	60 8 1/7	67½ 8 7/16	75 8⅓	82½ 8¼	7½
8	16 16	24 12	32 10⅔	40 10	48 9⅗	56 9⅓	64 9 1/7	72 9	80 8⅘	88 8⅘	8
8½	17 17	25½ 12¾	34 11⅓	42½ 10⅝	51 10⅕	59½ 9 1/12	68 9 5/7	76½ 9 9/16	85 9¼	93½ 9 7/20	8½
9	18 18	27 13½	36 12	45 11¼	54 10⅘	63 10½	72 10 2/7	81 10⅛	90 10	99 9 9/10	9
10	20 20	30 15	40 13⅓	50 12½	60 12	70 11⅔	80 11 3/7	90 11¼	100 11⅑	110 11	10

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CHAPTER VI.

The Daylight Enlarging Camera—How to Construct It.

The alternative, and, in my opinion, preferable mode of working, is by employing what is known as an enlarging camera. Its chief advantage over the method just described is that it can be used anywhere, in any room, or even out of doors; it also comes in very handy for copying purposes, and is, moreover, available for making lantern slides. It is rather a costly piece of apparatus to buy, but as its construction presents no great difficulty to anyone able to use ordinary carpenter's tools, I propose to give a few practical directions for making one at home.

The general form of the enlarging camera is shown in fig. 1, which is, in fact, a reproduction from a photograph of one which I constructed for my own use. It consists really of a large camera provided with a long baseboard and bellows, so as to allow of considerable extension. The bellows is divided into two compartments, as it were, by

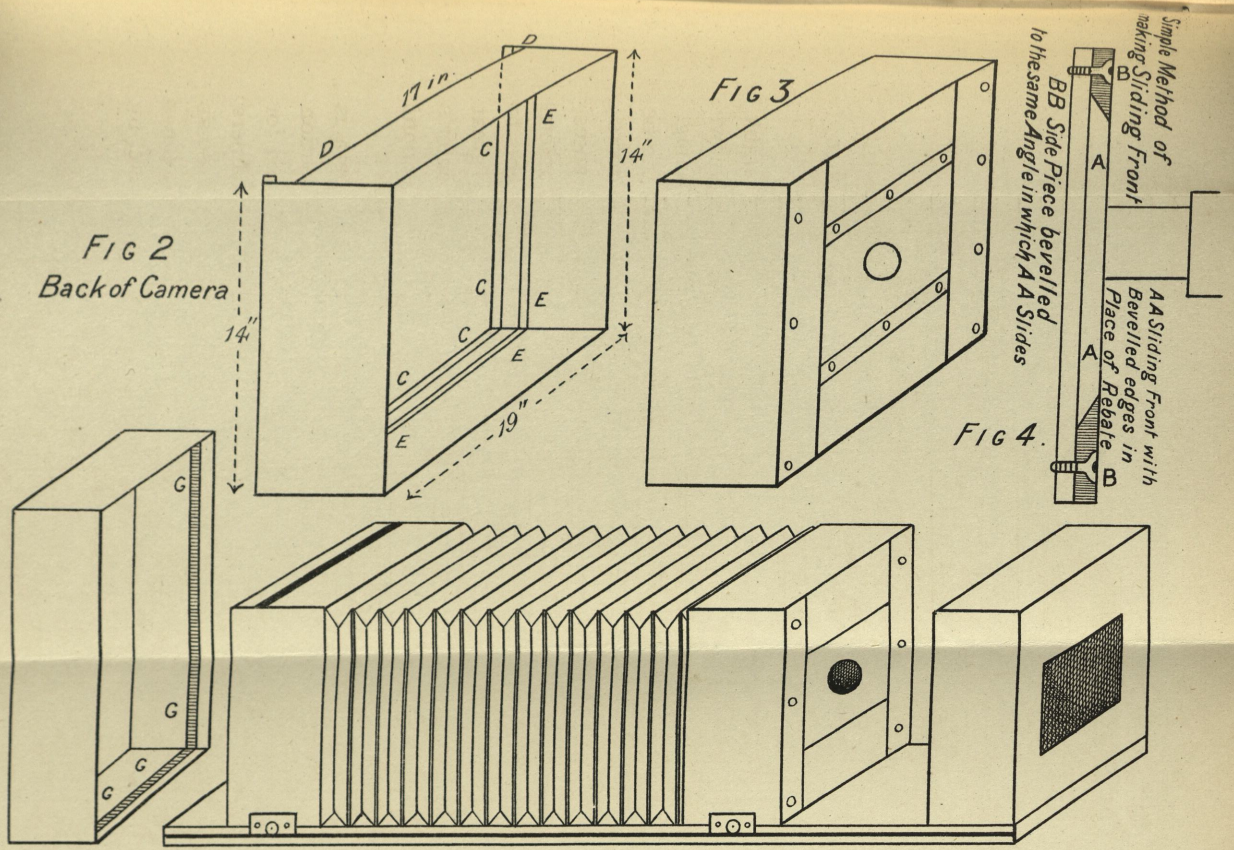


FIG 2
Back of Camera

FIG 3

Simple Method of making Sliding Front

BB Side Piece bevelled to the same Angle in which A A Slides

A A Sliding Front with Bevelled edges in Place of Rebate

FIG 4.

FIG 5
Camera Front

FIG 1. The Enlarging Camera

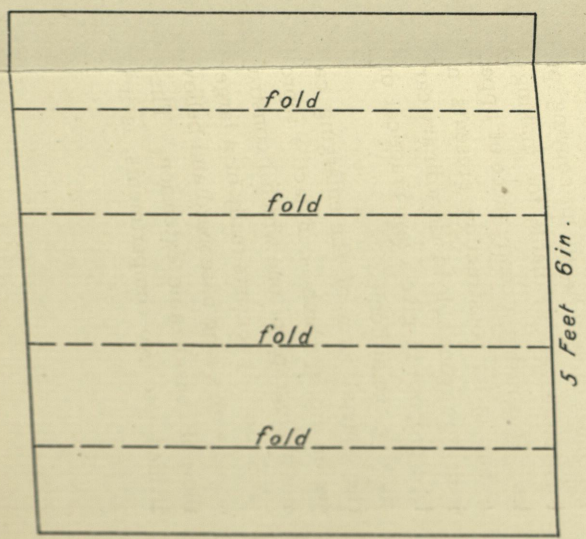


FIG 6 Plan of Bellows

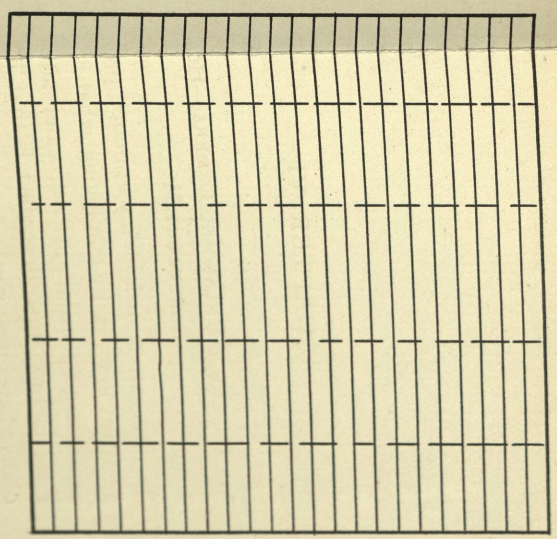


FIG 7

an adjustable partition, which carries the lens the extreme front portion of the camera containing a carrier to hold the negative to be enlarged.

The first thing to be done is to procure a single-back, such as is ordinarily used for the wet-collodion process, of dimensions sufficiently large to hold plate or paper of the size the enlargement is intended to be. It will be best, for obvious reasons, to build the camera too large rather than too small. I would suggest, therefore, 15 × 12 as a convenient size, though, of course, a larger or smaller one may be chosen; my own takes plates 12 × 10. Such a dark slide may be generally met with at the second-hand dealer's for about 10s. or 15s., according to its condition, and, if possible, the focussing screen should be bought with it. Very frequently old cameras are to be met with at pawnbroker's, or in sale rooms, and, if one can be obtained cheap, it should be secured, as it would serve as a basis for our operations, and save a good deal of time in constructing the apparatus. We will assume that a 15 × 12 slide has been procured, the outside dimensions of which are 17 × 14. Some clean, well-planed floor boarding must also be obtained. This is generally about an inch thick and five inches wide. One piece 19in. long and two pieces 14in. long are cut off

and glued, and nailed together, as shown at fig. 2. This will form the back of the camera, and the dark slide should just fit in comfortably. A fillet of wood $\frac{3}{4}$in. square is glued to one end, as shown at C C C C, to keep the slide in position. Another piece of the floor boarding 17in. long is then to be nailed and glued in to form the top, sufficient space being left at D D to allow of the easy insertion of the dark slide, which may now be temporarily placed in position, four additional fillets of wood being glued inside at E E E E. We have now the back of the camera with a groove formed by the fillets to hold the dark slide and the ground glass screen. Two additional frames of precisely similar dimensions, but without the groove, are then to be constructed of the same materials. The first of these will form the central portion of the camera, on which the lens is to be placed. This is shown in perspective at fig. 3. We may, if we please, entirely board in the front, and having done so, find the centre, cut out an opening sufficiently large for the lens, and screw on the flange. It will, however, be found extremely convenient in practice to be able to change the position of the lens, and thereby alter the position of the enlarged image on the plate. To effect this a cross-motion front will be

necessary, the construction of which it is hardly necessary to go into in detail; the fronts usually slide in rebated grooves, but a simpler and equally effective method is shown in section at figure 4. The third frame, which will form the front of the enlarging camera, is now taken in hand. Some one inch fillets are glued in a quarter-of-an-inch from the front, as at GGGG in figure 5; against these fillets the carrier holding the negative to be enlarged will rest. The baseboard must now be constructed. For a camera of the dimensions we are considering this should be at least six feet long, and it may also be constructed of planed floor boards. Its width must be equal to that of the camera proper, namely, 19 inches. A $\frac{1}{4}$in. groove is to be made down each edge with a plough plane. The woodwork of the camera is now complete, and will be ready for the insertion of the bellows. The making of the bellows, although apparently difficult, is really an exceedingly easy matter, although rather tedious. Procure some common twill lining from the draper's and some brown carpet paper. The outside dimensions of the bellows when completed will be 16in. by 13in., and it should be capable of extending to about 5ft. We shall, therefore, want a piece of material for folding 5ft. 6in. by 4ft. 11in. We therefore join

several pieces of the brown paper together to form one piece that size. Some good but thin paste is then made, and the black twill is pasted down on the paper until it is completely covered, overlapping at the joins as little as possible. It must not then be disturbed until it is dry, which may take twenty-four hours. It is then turned over, and the reverse side is covered in a like manner with the cotton lining. When it has dried it is ready to fold. All these operations, by the way, will probably be most readily performed on the floor, unless a table sufficiently large for the purpose is available. A piece of tailor's chalk is taken, and the pasted material is accurately marked out as shown in fig. 6. Fold the material at the marks, and well press each fold with a stout bone paper-knife. Having done so again, open out the material and mark parallel lines with the chalk, as shown in fig. 7, at right angles to the lines previously made. The bellows may now be folded at these lines, exactly as one would fold a paper fan, or a concertina—one fold up, the next fold down, care being taken to well press each fold. When the folding is finished, stretch out the bellows and bend round at right angles, and commence to nip each fold at the angle between the finger and thumb. When one side is

done, the remaining three sides must be treated in the same way. The operation is a very simple one, though extremely difficult to describe ; a glance at the ordinary bellows on one's camera will show how the folds should be made more graphically than a long description. We have allowed an inch for overlapping ; some thin glue is rubbed down this, the two pieces brought together, rubbed down, and the bellows is complete. When dry it may be glued to the back and front portions of the camera. We have, as yet, made no provision for focussing. A rack and pinion, or a winch screw, may, of course, be fitted ; but I find in practice that it is far easier to focus with the simple sliding motion. Two brass plates, with turned-up edges, one fitted with a screw nut to clamp the camera when the focus is arranged, can be procured from a camera-maker, and screwed to the sides in such a manner that the turned-up edges slide easily in the groove, which has already been made on the edge of the baseboard. The front portion of the camera is to be fitted in in a precisely similar way. The whole of the camera may now receive a coat of dead black, and is virtually complete. It is better, though not imperative, to cover in the space between the lens and the negative so as to only allow the light

passing through the latter to reach the former. A secondary bellows may be employed to effect this, or an easier plan would be to tack a piece of black velvet to the front of the camera which holds the negative, which, when the necessary adjustment of the camera has been made, can be pulled over the portion holding the lens, thus excluding extraneous light. The camera is now complete, and the way I prefer to use mine is to place it at an angle against a window facing north, as shown at fig. 8, so that the direct light from the sky is utilised. This mode of working renders focussing easier, and considerably shortens exposure. In order to avoid using carriers in the dark slide, to take different sized plates and paper, I procure a piece of glass (patent plate, if possible) the full size, and cement it inside the slide, and upon this I lay the plate or paper which is to be exposed. A piece of felt the same size superimposed on the plate or paper will keep it from slipping during exposure. This will, of course, throw the focussing screen out of register to the extent of the thickness of the glass used in the dark slide, and the necessary adjustment must be made. If the glass used in the slide and the ground glass are of the same thickness, this may be easily done by simply reversing the focussing glass and turning its

ground face outward. This will also render focussing a more easy matter. It might be thought that causing the enlarged image to pass through a sheet of glass in the manner suggested might result in disturbing the chemical focus or achromatism of the lens. This, however, does not occur in practice, and, although I invariably work in this way, I never find the slightest falling off in the sharpness of the enlarged image, but the convenience of so working is extremely great.

CHAPTER VII.

Accessory Apparatus and its Construction.

In describing the darkened room method of working, directions were given for making a simple form of table easel for holding the sensitive paper during exposure, but if much work has to be done, the employment of a properly-fitted enlarging easel becomes, if not an actual necessity, at any rate a very great convenience. This, like almost every other requirement of the photographer, is a purchaseable commodity, for easels embodying every possible facility for ease in working are now to be obtained from the various dealers in apparatus. Those, however, who prefer to make their own may easily do so by following these instructions. Some smoothly planed pine 3in. × 3in. in dimensions is procured, and a mortised frame 2ft. square is made as shown in fig. 1. Two pieces of 1in. board, 5ft. long and 6in. wide, are then to have a long slot cut $\frac{3}{8}$ of an inch wide and 2ft. long as shown in fig. 2 at A A. These are to form the uprights, and should be screwed to the base at BB (fig. 3), side struts being added to give strength as

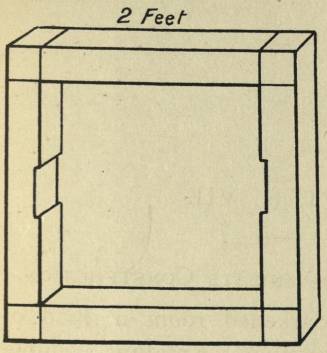


FIG 1
Base of Easel

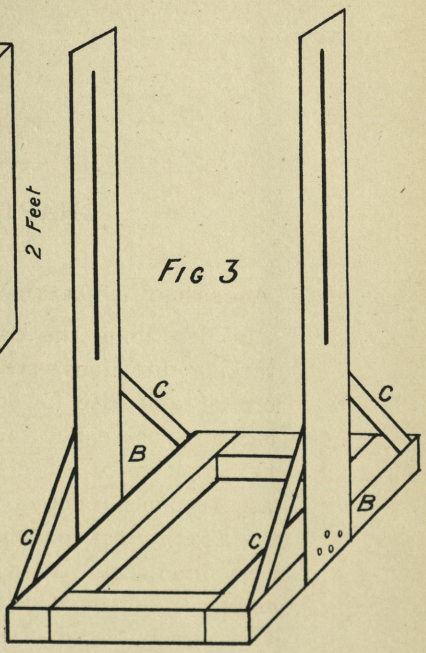


FIG 3

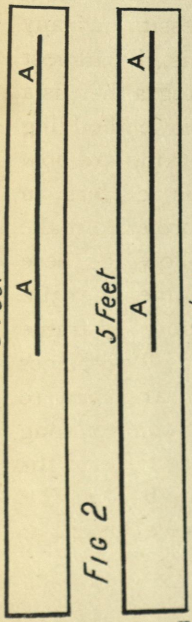


FIG 2
Supports for Easel

Section of Wood for Trays
ACTUAL SIZE

FIG 4

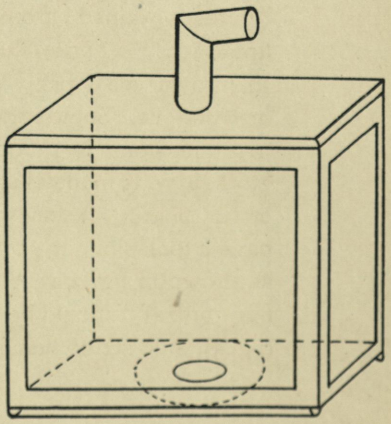


FIG 5 Lamp

at C C C C. This will form the framework and support for the easel, which should be made of pine, smoothly planed, and clamped like an ordinary drawing-board to prevent warping. Its width should be such that it just fits closely between the two uprights. Two large camera screws put in the sides will enable it to slide up and down the grooves in the uprights for the purpose of adjusting the image, and will also afford a swing back motion, which will often be found useful to bring any desired portion of the enlargement into sharper focus. It is, as I have before indicated, very necessary to keep the various portions of the apparatus parallel, and the best mode of keeping the easel so is to mount it on runners which run upon rails screwed to the floor. The rails and wheels may be obtained from any furnishing ironmonger, and are commonly used for the sliding doors, which, in modern houses, have now largely taken the place of the old-fashioned folding doors. This permits of the easel being readily adjusted to an approximate focus, the final focussing being effected by moving the lens. The best way of attaching the sensitive paper to the easel is to procure some stout elastic band about $\frac{1}{4}$ of an inch wide, and tack strips along each edge of the backboard; the paper can

then be slipped underneath these, and will be firmly held in position for exposure without the aid of drawing-pins.

Several large trays for developing and washing will form an indispensable portion of the practical enlarger's equipment. For developing purposes glass or ebonite dishes are most suitable, though both, in the larger sizes, are rather costly. For washing the enlargements, porcelain or wooden trays or dishes are extremely convenient; glass-bottomed trays with wooden sides are easily constructed. Some straight grained pine, free from knots, about $\frac{3}{8}$ of an inch in thickness and $2\frac{1}{2}$in. deep, is procured, and a rebate $\frac{3}{8}$ of an inch deep cut out as shown in fig. 4. Four strips of this must be cut for each tray of dimensions suitable for the size of the enlargements; for instance, 16 × 13 for a 15 × 12 paper. These must be carefully nailed together to form a tray with a rebate running round the bottom, into which a piece of sheet glass is to be carefully fitted. Some solid paraffin wax should be melted and allowed to run round and fill up any gap or crack between the glass and the wood, and when this has solidified some narrow strips of wood must be carefully bradded round to keep the glass in position; a final coating of the woodwork, inside and out,

with either the melted paraffin or a strong solution of shellac in alcohol, will complete the dish, which, with careful usage, should last for years. Trays for washing purposes can be similarly made, but should be deeper, and have, by preference, wooden bottoms, being finally well coated with the melted paraffin.

I have already pointed out the necessity for an abundance of yellow light in the dark room when developing bromide enlargements, and when working by artificial light the best means of securing this is to have a good, large lantern. Now, most commercial lanterns are far too small, unless a very high price is paid, and the ventilation is not always so perfect as it might be, but if the operator makes his own lantern he can see that these points are attended to. Procure a large biscuit tin. Get a tinsmith to cut out three sides as shown in fig. 5; these are to form the windows, and should have canary fabric pasted over them. A hole two inches in diameter is to be cut out of the centre of the bottom, and over that, inside the tin, a disc of tin eight inches in diameter is to be soldered, so as to form a ventilating light trap. A hole should be cut in the centre of the lid, and a stove pipe "elbow joint" soldered in to form a chimney. Two strips of tin should be soldered on the bottom

in order to raise the lamp above the table, and allow of the free ingress of air. To use the lamp place a thick carriage candle inside, light it, and put on the top. My lamp, made in this way, cost me, including the tinman's labour, 3s., and is a thoroughly reliable and efficient article.

Large carriers, either for use in the dark slide or for holding the negatives intended to be enlarged, may be easily made. The materials necessary for their construction are simply some sheets of white Bristol board, some thin glue, and some very thin wood, such as is used for fretwork, about $\frac{1}{8}$in. thick. Supposing that we wish to construct a carrier to place in the front of the camera to hold the negative to be enlarged, a piece of the Bristol board is taken and cut so that it exactly fits in the rabetted recess of the front, formed by the fillets which we glued in. Supposing, for the sake of illustration, that the carrier is to hold 5 x 4 negatives, an opening $4\frac{3}{4}$ x $3\frac{3}{4}$ is cut out exactly in the middle. Four pieces of the thin fretwood are then to be cut out and glued down on the Bristol board, so as to leave an oblong opening a trifle over 5in. x 4in. in dimensions; the projecting card will then form a rebate to prevent the negative from falling through, two small brass turn buttons serving to hold it in position. A

good coat of dead black, when the glue is dry, will finish the carrier. If carriers are required for use in the dark slide, they can be made in a precisely similar manner. The drawing (fig. 7) will, perhaps, render the description easier to understand.

SECTION 3.

THE PROCESS.

CHAPTER VIII.

ENGLARGING ON GELATINO-BROMIDE PAPER—PRACTICAL DETAILS—ALPHA PAPER.

Enlarging upon gelatino-bromide paper is the process *par excellence* for the beginner, and there is no doubt that in point of convenience it possesses advantages not found in any other, chief among them being its great rapidity, which enables it to be used effectively when only a weak source of light is obtainable. With such an advantage, it is not surprising that it should have rapidly ousted all older methods from public favour, and become the favourite process. It is, moreover, an extremely easy one to work, and when properly and skilfully manipulated, is capable of producing results which leave little to be desired from an artistic point of view. At the same time, it must be confessed that, with injudicious treatment and want of care, no process

lends itself more readily to the production of bad work. In point of permanence, it compares favourably with other processes, provided always that certain essential conditions, hereafter to be noted, have been complied with. The range of colour obtainable is a fairly wide one, ranging from cold to warm black, by simply modifying the exposure and the mode of development, while, if subsequent toning is adopted, almost any shade of brown can be obtained. Correct exposure and normal development, when enlarging from suitable negatives, should give results leaving little to be desired from any point of view, and which might readily when framed and glazed be mistaken for platinotypes. Probably higher praise than this could not be at present accorded to any process, but it must be distinctly understood that only the painstaking and careful worker is likely to attain to results that will, from an artistic point of view, so favourably compare with that which is generally acknowledged to be one of the finest of known processes.

There are a great many different makes of bromide paper now in the market, and in point of excellence I think they are all fairly equal, though their relative rapidities vary considerably. For this reason, if for no other, I should strongly

advise the reader to make up his mind which particular manufacture he elects to choose, and keep to it until a thorough knowledge of the process is obtained. Variation in rapidity, however, is not the only reason for so doing, for each particular make of paper possesses certain characteristics which distinguish it from others, and, as it were, give it an individuality of its own. For instance, one very popular make of paper is very prone, in the hands of a novice, to give hard prints, devoid of half tone, though the same paper when suitably manipulated is capable of rendering every shade of gradation existing in the negative. Again, with the paper of another manufacturer, many beginners experience the greatest difficulty in obtaining vigour, though, similarly, the ault lies with the operator and not with the material.

The question of roughness of surface is purely a matter of taste, and all manufacturers now coat paper of different degrees of roughness. Generally speaking, the finer surfaced papers will be found most suitable for small sizes and contact printing, the rough surfaces being best for enlarging upon, particularly if the degree of magnification be very great, in which case very rough surfaces indeed may be employed with advantage. Very copious instructions in the use of the paper are issued

with each package, and these should be most carefully read, for it is only fair to assume that the maker is at least as well acquainted with the treatment best suited to his own productions as anyone else can be. Let it be understood, therefore, that these hints and suggestions are intended to supplement merely, and not to supplant, the instructions which accompany the paper.

The first point to be attended to is the nature of the light by which we intend to work. When we learn that the most rapid bromide paper is very much less sensitive than the slowest bromide plate it becomes apparent that we may use not only a brighter light but more of it. For bromide printing ruby light of any kind is a mistake; a good yellow light and plenty of it is far more suitable. Yellow fabric, such as is obtainable at any photographic dealer's, forms the best medium, and one thickness will be ample. My own dark room window is covered with this material, behind which, about 18 inches always, burns an ordinary batswing burner, and with the light so obtained I can see to read a newspaper comfortably. This question of lighting is a more important one than it would at first seem to be, and for this reason, that the progress of the development of the print requires to be most closely watched, its removal

from the developer at the proper moment without hesitation being a matter of vital importance, and one upon which the excellence, or otherwise, of the final result will largely depend.

In regard to the choice of a developer, a great deal of difference of opinion at present seems to exist. Hydroquinone is warmly advocated by many, and, certainly, if that were all, it possesses a great advantage in point of cleanliness and freedom from any propensity to stain ; but I frequently find that the colour of the print leaves much to be desired, and the tendency to clogging of the shadows before the half-tones are properly out is frequently very great. At the same time, if the exposure has been approximately correct, and the negative presents no very severe contrasts, very good results may be attained.

Eikonogen seems to promise well as a developer for bromide prints, although I find it gives rather dissimilar results with different makes of paper —yielding in some cases a fine black colour, and in others a warm brown, but always showing a good gradation and an absence of the exaggerated high lights and blocked shadows which are so often met with when using hydroquinone.

But for bromide paper the ferrous oxalate developer is, in my opinion, by far the best,

inasmuch as, when it is properly understood, almost any desired effect can be obtained with it. Absolute cleanliness in all manipulations is, perhaps, more imperative with this developer than any other; the slightest contamination with even the merest trace of pyro or hypo, or other chemical, will be fatal to good results. It is, therefore, *absolutely imperative* that the dishes used for developing bromide enlargements with ferrous oxalate be kept for that specific use only, and it would be well, also, if the same rule were applied to the trays used for washing and fixing. The developing tray should always be cleaned after use and before being put away. I say "cleaned" advisedly, because washing with ordinary tap water, which very often holds various carbonates in solution, will not suffice, as the hard water in the presence of the ferrous oxalate throws down an insoluble precipitate which is extremely difficult to get rid of. The dishes, therefore, should be first rubbed with a cloth dipped in a solution of hydrochloric acid and water, which will remove the deposit; a subsequent rinsing in clean water will then, of course, be necessary.

The stock developer consists of saturated solutions of oxalate of potash and sulphate of iron. The former may with advantage be made up in bulk,

as it does not appear to in any way deteriorate by prolonged keeping. To make it, put 2lbs. of oxalate potash in a stone jar, and pour over it five pints of boiling water. This should be violently agitated until the solution cools. The solution must then be tested with litmus paper, and will probably show an alkaline reaction, in which case oxalic acid must be added until litmus paper distinctly reddens. This forms the stock solution No. 1, but it should not be used direct from the jar, a better plan being to filter off a small quantity from time to time as occasion may require. The No. 2 solution of sulphate of iron is quite as easily prepared, but is more difficult to keep, and as a much smaller quantity, comparatively, is used than of the oxalate, it is not well to make up too much at a time. Sulphate of iron, in clean, bright green crystals, is dissolved to saturation in hot water, the cooled solution being made distinctly acid by the cautious addition of sulphuric acid. This is part of the secret of imparting to it good keeping qualities—the remaining precaution being to keep the stock bottle tightly corked, or stoppered, and full up to the neck. A ten per cent. solution of bromide of potassium completes the developer. An acid clearing bath to prevent the precipitation of the iron in the pores of the paper will be neces-

sary. Various acids are recommended for this purpose. Personally I prefer acetic acid, and I use it in the proportion of one dram of the acid to a pint and a half of water. The fixing bath should always be a new one, and should contain about three ounces of the hyposulphate to the pint of water. In this connection it may be well to refer to a charge, namely, that of want of permanency, which is sometimes brought against bromide prints and enlargements. I believe myself that a properly fixed and washed bromide print is likely to be as permanent as any other process, and that where fading has occurred it may be more often traced to imperfect fixation than to imperfect washing. Therefore, I would strongly recommend the adoption of two fixing baths, giving the print ten minutes in each. If this plan is adopted, and the prints are properly washed, little fear need be entertained on the score of fading.

Correct exposure can only be learnt by practice, and no rule for determining it can be definitely laid down. With artificial light the factors which determine it remain fairly constant, and errors are not so likely to occur, but with daylight, on the other hand, the constant variation in the actinic value of the light which is always occurring renders accurate judgment in this respect a more difficult

matter. In either case it is better to make a test exposure on a small strip of paper before exposing the large sheet, as by so doing waste will be avoided. My own method of working differs considerably from that recommended by the makers. I will not venture to assert that it is better, but, in my hands, it is more certain and gives me uniformly good results. I have, therefore, no hesitation in recommending the novice to adopt it. In the first place, I give what would be a very full exposure, if development were conducted on the lines laid down in the printed instructions accompanying the paper—that is to say, if one minute were the ordinary time of exposure, I should give from one and a half to two minutes, and my developer would be compounded as follows :—Supposing I wished to make 6 ozs. of mixed develeper, I should take 3 ozs. of the oxalate solution, to which I should add ½ oz. of the iron, and 2 drops of the 10 per cent. solution of bromide of potash, making up the bulk to 6 ozs. with distilled water ; *tap water will not do*, as it would cause a precipitate of oxalate of lime. It will be seen that my method is simply to give a full exposure, and develop with a dilute and well-restrained developer. If the exposure has been suitable the picture will

appear slowly, and gradually gain in strength until all detail is out; it must now be closely watched, for if removed from the developer at this stage it would probably be found to be lacking in density. The darkening, however, takes place more rapidly towards the conclusion of development, and only observation and a little practice will determine the proper time for its removal. The picture should be allowed to develop a little darker than it is to appear when finished, as there is usually a slight reduction in the fixing bath. It is well to have the bottle containing the clearing solution convenient to hand, so that the clearing bath may be poured over the enlargement directly development is complete. This at once arrests development, and prevents the formation of any deposit on the paper. After the acid bath has been allowed to remain on the print for a few minutes, it may be poured back into the bottle for future use. The print itself must then be most thoroughly washed in several changes of water, for, if the acid be not thoroughly removed, more or less reduction will take place in the fixing bath. I have already alluded to the utility of employing a second fixing bath, and I will not further refer to the matter, beyond expressing the opinion that perfect fixation is almost more essential

to the permanency of a bromide print than prolonged washing. I wash my own bromide enlargements by putting them in a large porcelain dish, to the bottom of which water from the tap is conducted by means of a piece of rubber tube.

The prints must be allowed to dry spontaneously, and must not, of course, be dried between blotting-paper. I generally pin them down by the corners to a flat surface, such as a table-top, until they are dry. Mounting is best done with starch, and care must be taken not to allow any to get on the surface of the print, otherwise smeary marks are liable to show.

Enlargements, produced by the foregoing mode of working, should be of a fine black colour, and should reproduce every gradation of the small original. I propose now to describe two methods by which the colour of the image may be changed from black to almost any shade of red or brown. The first method is that with ferricyanide of potassium and nitrate of uranium, the application of which, to this purpose, was, I believe, first publicly referred to by Mr. Weir Brown some short time back. I had, however, "toned" bromide enlargements in a similar way, as far back as 1885, but did not deem the application of a well-known method of intensification to

such a purpose a matter of sufficient novelty to publish. I also found a great tendency to stain the paper—a defect, it is fair to Mr. Brown to acknowledge, which the addition of acetic acid, to a great extent, removes. The proportions recommended by Mr. Herbert Fry are as follows:—(1) Ferricyanide of potash 20 grains, acetic acid ½ ounce, water 10 ounces. (2) Nitrate of uranium 20 grains, acetic acid ½ ounce, water 10 ounces. Equal proportions of the solutions are mixed just before being required for use. Mr. Fry recommends that the print be fixed, washed, and dried, before the toning is proceeded with. He then soaks the print in clean water and lays it face upward on a sheet of glass. A large handful of cotton-wool, after having been rinsed in water and squeezed nearly dry, is dipped in some of the toning solution and applied by mopping and sponging boldly to the surface of the enlargement, plenty of solution being used. When the toning is sufficiently deep, the print is to be washed with a fresh cotton-wool mop until the yellow stain is removed from the fibre of the paper. The advantages of working in this way are that the toning action is more under control, less solution is required, and there is less tendency to stain the paper.

The second method of toning, and the one which I prefer, I have never yet seen recommended. It consists simply in using the intensifier supplied by the Plantinotype Co. diluted with an equal bulk of water. The composition of this preparation is a trade secret, but it is believed to be a combination of mercury and platinum. Therefore there might, its composition being unknown, be some reason for doubting its permanency, but I have by me, at the time of writing, some prints so treated which were prepared three years ago, and which do not show the slightest sign of deterioration. I therefore feel quite safe in recommending the method to the attention of all workers in bromide. The colours obtainable are very fine, rich, warm browns, quite different from the rather red and foxy tones sometimes produced by the uranium method.

Alpha Paper. This paper as originally issued was very much more rapid than it is now made. Enlarging by daylight and using a lens stopped down to about f/16, I used to find an exposure of from quarter of an hour to 20 minutes to diffused daylight gave me excellent results, but I now find, working under similar conditions, that something like an hour's exposure is necessary. This alteration in its manufacture, therefore,

practically removes it from the category of enlarging processes. Personally I extremely regret the change, as the warm browns and sepia tones which were obtainable by its use were extremely suitable for many subjects.

CHAPTER IX.

The Making of Enlarged Negatives.

We have now to consider that which is undoubtedly the best of all enlarging methods, viz., the production of enlarged negatives. This process has several advantages over what I may call "direct" methods, in that it permits of the improvement of the original at different stages of the work, and the print may be produced by the process considered most suitable to the subject. I have not the slightest hesitation in asserting that in the hands of a clever worker the enlarged negative will, in many cases, be an improvement on the original. I have experimented a great deal in this direction, and after a most careful comparison of prints from both direct and enlarged negatives, I find that the latter, from an artistic point of view, are generally to be preferred. I am, however, confining my criticism to matt-surfaced prints, and not to prints upon albumenised paper. I am not going to assert that an enlarged negative is as pretty a thing to look at as one taken direct, or that there is invariably an entire absence of

granularity, for, as a matter of fact, it would be, generally speaking, an easy matter to confute either statement. I have, however, ceased to regard certain qualities, sometimes referred to as "bloom," "pluck," "clean glass shadows," and so on, as being the *ultima Thule* of photography, and have learnt to look upon the finished print as the reward for my labours. It is a fact well known to most of us, that very often our poorest *looking* negatives give the best results in the printing frame. The amount of granularity present in the enlarged negative will obviously vary considerably, and will depend upon the degree of amplification, the kind o plate used for taking the original negative, its rapidity, the manner in which it was developed, and upon the exposure given to it. Some plates show a much finer deposit on development than do others; but after a little experience the reader will quickly ascertain which plates are best suited to his purpose. If the finest obtainable results are desired, the degree of enlargement should not be very great. I find, in my own work, that enlarging the sized plates I generally use, namely, the 5 × 4, to 10 × 8, or four times the size of the original, I get very little granularity in the enlarged negative, and not any in the print. It will often be possible to

enlarge a negative four times, or two diameters, without showing granularity, when if the amplification were increased to four, or more, diameters, the amount of granularity produced might be very great. The best results will always be obtained when enlarging from negatives taken on slow plates which have received time exposures—in fact, the shorter the exposure, and the more forced the development, the greater the amount of granularity likely to occur. In other words, a slow plate with a normal exposure and development means a fine deposit ; and the converse conditions, namely, a rapid plate, short exposure and forced development, a coarse deposit.

In point of convenience in actual work, the enlarging camera, the construction of which was described in chapter 5, will be found more handy than what may be called the darkened-room method. Of course, either mode of working may be adopted, but, personally, I prefer to use the camera, one reason being that I find it an easier matter to focus with the camera than with the easel. This focussing of the enlarged image is a matter which must be most carefully attended to, as upon it the definition of the enlarged negative will, in a great degree, depend. With some negatives, particularly such, for instance, as

exhibit a large surface of foliage, it is difficult to see when a sharp focus has been obtained, more particularly if the light should not be very bright. In such a case I make use of a special negative which I keep by me for the purpose. It is an architectural subject, with clear cut lines, thin and clean, and was developed with hydroquinone. With such a negative it is easy to obtain a sharp focus. The camera is then clamped up, the test negative removed, and the negative to be enlarged inserted in its place.

Broadly speaking, there are two modes in ordinary use of producing an enlarged negative. By the first method a transparency is made by contact from the original small negative, which, when dry, is placed in the enlarging camera, and an enlarged negative in turn produced from it. The alternative method, and the one which I consider gives by far the finest results, is to make, in the first place, an enlarged transparency in the enlarging camera from the small original negative, and then from that print by contact an enlarged negative. I am convinced by numerous experiments that the latter method gives far more definition and gradation than the former, and it allows, moreover, greater scope for the exercise of the ingenuity of the skilful worker in retouching and

improving both the positive and the negative.

In referring to the question of granularity I indicated, generally, the kind of negative that would be likely to produce the best result for enlarging purposes. Negatives taken specially with a view to their ultimate enlargement should, whenever practicable, receive a full exposure, and the development should not be carried so far as to block the high lights, a negative inclining to softness generally giving the best results. We have, however, very often to do the best we can with what we have got, and luckily it is in our power in making an enlarged negative to very much modify, or, if need be, entirely alter, the effect obtained from the original negative. For instance, supposing the small original produces a hard chalky print, by giving a full exposure to the transparency, and modifying the developer so as to prevent contrast as far as possible, and adopting the same principle in printing the negative from the enlarged transparency, we shall find that we have ultimately obtained, in the resulting enlarged negative, a result very different in character to the original negative. I do not find that the colour of the original negative exercises any appreciable influence upon the character of the result, although for a long time I inclined to the opinion that the

best results were obtainable from negatives of a yellowish tinge which had been developed with plain pyro. In the case of a very thin negative a better result will be obtained if it be varnished at the back with ordinary negative varnish which has been slightly coloured with aurine.

For making the enlarged transparency, either an ordinary dry plate may be used or one specially prepared for transparency work. I think perhaps the best results are to be obtained on a transparency plate containing a cloride such, for instance, as those prepared by J. D. England or Thomas. I generally use, however, for this purpose Ilford ordinary, and I am very well satisfied with the results I obtain from them. The exposure, of course, will vary with the lens aperture used, the aspect, the time of year, and the density of the negative, but I find using Ilford ordinary plates, and the lens stopped down to f/16, that with an average negative an exposure varying from 20 secs. to a minute is required. Whether a full exposure, or a short-timed one, will be most suitable to obtain the effect aimed at, the reader will have to determine for himself, bearing in mind the foregoing observations on the character of the negative to be enlarged.

For developing the transparency I find pyro

more suitable than ferrous oxalate, in that it is more amenable to modification in the event of error of judgment in exposing. Of course, the appearance of a transparency developed with pyro is not so good as one developed with ferrous oxalate, but for this purpose the transparency is only a means to an end, and utility must be considered before beauty. As it is sometimes necessary to keep the developer on the plate, or a portion of the plate, for a considerable time, I prefer to use a developer containing sulphite of soda, in order to avoid discolouration or staining. The sulphopyrogallol of the Platinotype Co. is excellent for the purpose.

The transparency, when washed and dried, can be carefully examined, and, if necessary, retouched. I am aware that this is a delicate subject with some people, but I confess that I have yet to be convinced of the immorality of rectifying, where it lies in the power of the photographer to do so, the shortcomings and failures of his process. At any rate, it is possible, for those who have no scruples of the nature referred to, to very considerably improve the transparency, and consequently the finished print, by a little judicious retouching. The appearance of the transparency may be taken as a guide to the effect which will be obtained in the ultimate

print. We can, therefore, in any retouching which we may attempt, see the effect that we are producing as we progress. It is really wonderful the improvement that may be effected by just deepening a shadow or putting in a few details in a high light, and until one has demonstrated this for himself he can have no idea of the power which is placed in his hands. The surface of the negative, where retouching is necessary, must be prepared in order that the pencil may "bite," and as in most cases only local retouching will be necessary, the easiest mode of doing this is to rub the tip of the forefinger on a ump of resin until it feels "tacky," and then to rub the portion of the negative which is to be worked upon with a light circular motion. When the surplus resin has been dusted off, the negative will be in a fit condition for the pencil. Where a considerable area of the negative is to be retouched it will be better to apply one of the well-known retouching varnishes. Ordinary pencils of good quality may be used, and the most useful grades will be H, HH, and HHH, softer pencils being useless for the purpose. The negative should be laid upon a retouching desk, or, failing that, pressed against a window-pane, so that the effect of each stroke of the pencil may be noted.

The "dodging" of the transparency having been

completed, all that remains to be done is to print a negative from it by contact. This may be readily accomplished by placing the transparency in a printing frame, putting an ordinary dry plate, or a special transparency plate, in contact with it, and making the exposure to artificial light. I find the exposure required by an Ilford ordinary, at a distance of six feet from a bat's-wing burner turned down rather low, is about four seconds, but this, of course, is only approximately correct. The development of the enlarged negative so obtained differs in no way from the treatment of an ordinary plate, and when fixed, washed and dried, it is ready for printing from.

It is unnecessary to go in detail through the alternative method of making a small transparency by contact from the original negative, and from that producing the enlarged negative in the camera. The observations already made apply equally to both methods. I have already expressed the opinion that the method first described produces the finest results, the only advantage of the latter mode of working being a slight saving in material, owing to the fact that a small plate instead of a large one is used for making the transparency.

CHAPTER X.

Printing from the Enlarged Negative. How to Sensitise Rough Papers, &c. Conclusion.

Although contact printing does not come strictly within the province of this work, yet a few words on the subject appear to form a not unfitting conclusion to the subject. I do not intend to refer to the well-known processes of contact printing which are commonly practised by photographers, such as the platinotype, bromide, and carbon processes, any of which may be employed for printing from the enlarged negative; but I wish to direct particular attention to the less known, but far older, process of printing on rough-surfaced papers, sensitised with chloride of silver, and toned with either platinum or gold. This process, I consider, allows the operator more scope for the exercise of taste and ability, in an artistic direction, than any other, and when rough Whatman paper is employed gives a finer and more artistic result than is obtainable from any process when printing from an enlarged negative. This is due in a great measure to the fact that the rough, broken-up surface of

the paper prevents any slight granularity which may exist in the enlarged negative from being reproduced in the print. If the reader elects to try this method of printing he will be compelled to prepare his own paper, for up to the time of writing*, paper of the kind I have indicated has not been introduced commercially. Matt-surfaced paper of a smooth texture can, of course, be obtained, but I am referring to much rougher surfaces.

The home preparation of it, however, is neither tedious nor difficult, therefore no considerations of that nature need deter even the veriest tyro from making his own paper. The manipulations are few and simple, and consist in salting the paper, allowing it to dry, and then sensitising with a solution of nitrate of silver. As I have previously said, I do not intend to go into minute details, and I shall content myself with giving a plain, practical description of my own method of working. Those who wish to study the matter more minutely will find all they require in the various text-books on photography, the information contained in which has been collected and published by Mr. Clark in "Platinum Toning," a work which the worker who sensitises his own material will find of the greatest assistance.

* November, 1891.

The paper I use for printing from enlarged negatives is, as I have already indicated, of coarse texture, being, in fact, the very rough paper prepared by Whatman for painting upon in water colours, and which is obtainable at all artists' colourman's for about 6d. a sheet. More expensive qualities can be obtained, and for large-sized pictures are to be preferred, as, being considerably thicker, they are less likely to tear. I would here remark that more care is necessary in manipulating these papers than when dealing with platinotype or bromide paper, as when wetted they become very liable to tear; indeed, the weight of a wet print in lifting it from one solution to another is enough, unless care be exercised, to cause the paper to tear.

The salting of the paper I perform in the following way:—I weigh out and put in a clean gallipot (by-the-way, if this has to be procured from the household authorities, freedom from any suspicion of grease, which would be fatal to success, should be secured by washing it in hot water and soda) 1 dram of Nelson's gelatine—I use the 6d. packets obtainable from the grocer—upon this pour half-pint of cold water, and stand by for an hour to allow the gelatine to swell, then add 1½ drams of ordinary table-salt, the

chloride of sodium of the chemist's, now put the whole upon the stove and dissolve by gentle heat, well stirring the mixture with a clean fork at frequent intervals. The paper to be salted should be cut up into pieces slightly larger in dimensions than the size of the enlarged negatives which are to be printed from, so as to allow for cutting off the margins, the sensitising at the edges of the sheet being generally unequal, the salting and sensitising fluids having a tendency to collect there. I adopt the method of salting the paper recommended by Mr. Clark. I use his modification of the Blanchard brush. I take a piece of celluloid and a piece of rough, clean flannel of similar dimensions, and double them over, and retain them in that position by the aid of a wooden clip. Mr. Clark recommends swansdown, but I find the flannel acts better, seeming to catch the surface of the paper and fill up its corrugations more readily than the swansdown. The gelatinised salting solution must be applied evenly, and care should be taken not to allow it to get on the back, or patchy prints will result. The solution should be kept hot while in use, as if allowed to get cool bubbles are formed by the action of brushing over the paper which would show distinctly in the finished

print. The paper after coating may be allowed to dry spontaneously, or by heat, that is to say, it may be held in front of a fire or over a gas jet or a lamp. In this condition it will keep for any time, and is, of course, unaffected by light. In order to sensitise it it is brushed over with a brush made as before described with the following solution:—Dissolve 100 grs. of citric acid in 2 ozs. of water, and 240 grs. nitrate of silver in another 2 ozs. of water. The two solutions are mixed, and form the sensitising solution. The solution will keep good for a long time, and I find that paper coated with it, if kept between blotting-paper under pressure, will keep at least a month in cool weather, but I prefer to prepare the paper freshly. Care must be taken to use a sufficient quantity of silver, and to see that the whole sheet is covered. The solution must, in fact, be well brushed in, otherwise insensitive patches may result owing to the repellent nature of the paper preventing the absorption of the solution.* The paper after sensitising may be allowed to dry spontaneously, or it may be dried by holding it over a gas flame, precaution being taken to

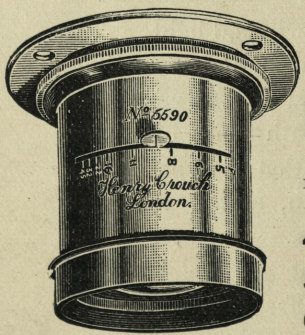
* Note, April, 1892.—I find, after further experimenting, that the solution can be better and more effectively applied by means of an ordinary hog-hair painter's brush than with the Blanchard brush above referred to.

prevent it from scorching. When dry the paper is ready for printing. It should be borne in mind that paper so prepared is far more rich in silver than commercial sensitised paper, therefore all negatives should be properly varnished in order to avoid silver stains, which are almost impossible to remove, and would spoil the printing qualities of the negative. A rather vigorous negative seems to give the best results with this process, and proofs must be rather overprinted, as the reduction in the toning bath, particularly if dark tones are desired, is considerable. Either Clark's platinum toning bath may be used, or any ordinary gold bath. I generally employ the latter, as it is much cheaper, and the results are very similar to those obtained with platinum. I find, however, that the following modification gives better results than the gold baths in ordinary use:—Dissolve in 12 ozs. of hot water, 20 grs. of acetate of soda and 10 grs. of phosphate of soda; when cool, add 1 gr. of gold; the solution is then ready for use. The prints must be washed before toning to get rid of the free chloride. They will be found to tone very rapidly, and if warm tones are desired care must be taken not to allow the toning action to proceed too far. It will be found better to tone

by diffused daylight than by artificial light, as the colour can be more readily judged, and, if possible, a wasted print should be toned first, as very often the first print placed in the bath tones unevenly. Fixing is performed in a solution of hyposulphite of soda of ordinary strength, and a thorough washing completes the process.

It is unnecessary to point out the facilities which prints so prepared offer for retouching, although, personally, I deprecate the use of either brush or pencil upon the print, notwithstanding that, within proper limits, I hold that improving the negative, when necessary, is not only desirable but legitimate.

CROUCH'S LENSES.



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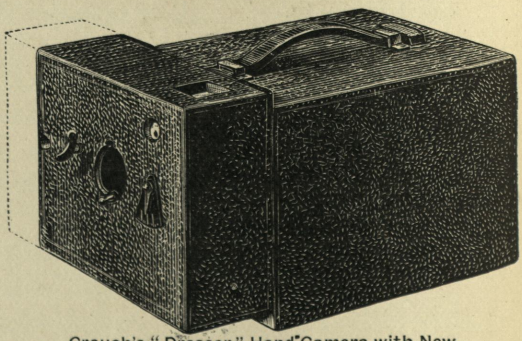

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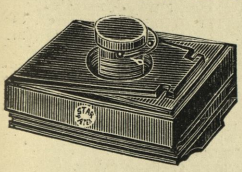

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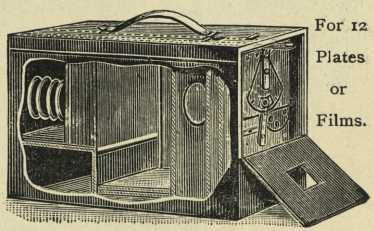

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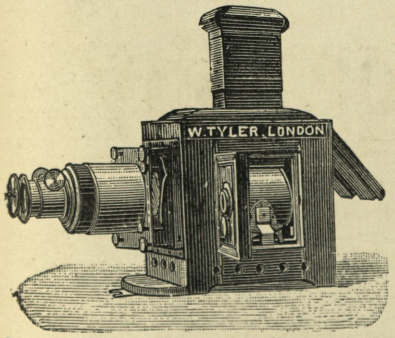

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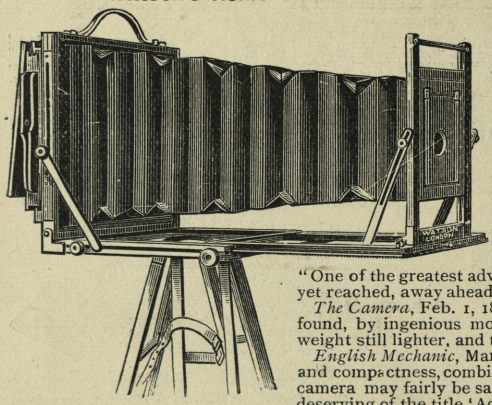

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